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SOME ACCOUNT OF EARTHQUAKES.



Ruins of the Cathedral of Lisbon, after the Earthquake of 1755.

In a previous number, a brief account was given of the *causes* which produce both volcanoes and earthquakes; but though these tremendous visitations have a common origin*, yet the appearances they present during their continuance, and their subsequent *effects*, are so different, that they should properly be described apart, in a paper intended only for the general reader.

When it is remembered that the very circumstance of a volcanic eruption, implies that a vent has been found, or made, for the mass of gaseous and fiery matter, which chemical agency has produced under the surface of the earth; it is not surprising that earthquakes to any alarming extent seldom accompany such catastrophes, or that they cease when the eruption takes place. It is in countries remote from active volcanoes, that the effects of the former are most widely and powerfully felt; in such, the efforts to escape, made by the imprisoned elements, convulse the ground for thousands of square leagues, bringing destruction to the habitations of man, and crushing him under the ruins of his own frail abodes; and when the overpowering force exerted by the subterranean matter rends the surface of the earth, chasms are opened, which in a few seconds often swallow up whole cities, with their

devoted inhabitants, and a dreary plain, a dismal lake, or a yawning gulf remains to point out the spot, where but a few hours before stood a flourishing town, swarming with thousands of human beings.

A torrent of lava or a shower of ashes, often has, and may again destroy cities; but there are always some previous warnings which allow the inhabitants time to escape; consequently the destruction of human life by volcanic eruptions only, is trifling compared to that caused by earthquakes; added to which, the devastations produced by the former are generally confined to the immediate neighbourhood of the mountain, whereas in the case of an earthquake, the suddenness of the crisis, and the extent of its influence, precludes the possibility of escaping the danger, while the mode of its approach, the rendering unstable "the fixed and firm foundations of the globe," so paralyzes with fear the minds of the victims, as to incapacitate them from making any efforts to avoid the coming danger.

In all ages this quantity of human suffering has excited sympathy, and called attention to these convulsions. In times of perfect ignorance concerning the laws of nature, they would probably have occasioned little remark, if their effects had been confined to the destruction of mountains, or the birth of new hills and lakes where none had before existed; events which in a greater or less degree always accompany these visitations.

It is for this reason that historical records of earthquakes are numerous; and of a few of these we propose to give such an account as our limits will allow; dwelling, for obvious reasons, chiefly on those which are most interesting for their moral, as well as physical effects.

Though the shocks of an earthquake are, as we before stated, fatally sudden in their approach, yet it must not be imagined that they inflict their visits without previous

* This common origin is proved by many circumstances; and the reader may be interested by the following facts illustrating this subject. The volcano of Pasto, east of the river Guaytara, sent out, without cessation, a tall column of smoke, for three months, in the year 1797: this suddenly ceased, at precisely the same moment that a violent earthquake occurred at sixty miles' distance, at Riobamba, which, together with a mud-eruption of the Moya, destroyed from thirty to forty thousand Indians. The sudden appearance of the island-Sabrina, in the Azores, on the 30th of January, 1811, was the forerunner of those fearful convulsions which, further westward, shook the Antilles, the plains of the Ohio and Mississippi, and the opposite coast of Venezuela, in succession, without intermission, from May, 1811, to June, 1813.

threats. These have been observed to be very similar in different countries and at remote periods, and generally consist in atmospherical, or, as they are termed, in meteorological appearances, which are now known to be intimately connected with changes in the electrical state of the earth and air; and very direct indications of these are always observable in volcanic eruptions as well as during and preceding earthquakes.

Variations in the usual course of the seasons, violent gusts of wind, or præternatural calms, rains in countries or at times of the year in which they are usually unknown to occur, a mistiness of the air often continued for months, and the consequent lurid appearance of the sun's face, flashes of lightning or noxious vapours from the surface of the ground, with subterranean noises resembling the rolling of carriages, the discharge of artillery, or distant thunder, are indications of the approaching evil.

Pliny, in the second book of his *Natural History*, has given an account of the principal earthquakes in ancient times; but this is mixed up with so much matter obviously fabulous, that little instruction or rational amusement can be derived from it; one of the most authentic is that which occurred in the year 17; and destroyed twelve cities of Asia Minor in one night. There exists a medal, struck during the reign of Tiberius, recording the rebuilding of these. The earthquake in the year 63, which partly destroyed, among others, the city of Pompeii, is familiarly known to our readers, from the interest excited by the discoveries which have been made there.

The city of Antioch affords an example of repeated suffering from earthquakes. In A.D. 115, it was destroyed by one which lasted several days; the Emperor Trajan happened to be in the town at the time with a large force, returning from one of his military expeditions; he escaped, it is said, with great difficulty, but an immense loss was sustained by his troops and the inhabitants. In 458, in the month of September, the city, which was once more flourishing, and thickly peopled, was again visited by a convulsion, which ruined it, and destroyed 40,000 inhabitants; and, before it could well recover this loss, in 525, under the Emperor Justin, a third earthquake, still more fatal, killed nearly 60,000; but this is a trifling fatality in one city compared with that which has attended Lima, as we shall presently see.

The accounts of these remote convulsions are, however, too vague to be interesting*, we, therefore, pass them over, till we arrive at the one of Calabria in 1638; of this Kircher has given an account, having been a witness to its horrors, in a journey he made from Sicily to the continent during its continuance. He, and four other persons, left the harbour of Messina on the 24th of March, and had not proceeded far, when the air and ocean gave manifest signs of some approaching catastrophe: Etna was seen to cast forth great volumes of smoke, which obscured the island from their view; the strange disturbance of the sea, and the dreadful noises, induced them to land at Tropæa, which they no sooner gained, than a shock ensued, which destroyed the greater part of the place. Compelled to prosecute their voyage, now seeking safety on shore, and now returning to their vessel, as dangers alternately menaced them by land or at sea, they witnessed the destruction of Rochetta and other places, but, on arriving within sight of the city of St. Euphemia, whither they were bound, they perceived a dark lurid cloud resting on the spot, though the atmosphere was otherwise serene; when this cleared off, the city had disappeared, and a lake occupied its place, and, during the remainder of their voyage to Naples, where they were now obliged to proceed, the whole coast, for upwards of 200 miles, presented one picture of ruined cities and houseless wanderers.

* Gibbon states that the loss was 250,000, and accounts for this enormous number by the multitudes attracted to the city to celebrate the festival of the Ascension.

† As a proof of the ludicrous ideas on the subject of earthquakes prevalent till very lately, a little work, entitled *The General History of Earthquakes, &c. &c.* by R. B. 1734, may be referred to. In a chronological list of all the remarkable ones which have ever occurred, the author invariably narrates cotemporary historical events, as immediately caused by, or connected with, the commotions; as a specimen take the following, selected from hundreds more, equally authentic and rational.—“In 1622 was a great earthquake in Italy; the shape of an elephant was seen in the air, and three suns. Armies fighting, monstrous births, waters turned into blood, unusual and impetuous tempests which overthrew several towers. At this time began the third civil war in France; the Prince of Condé is taken, and shot to death, with a pistol; the emperor prohibiteth the Protestant religion at Athen.” (1) &c. &c.

In 1693, after several previous shocks, one occurred on the 11th of January, which, in three or four minutes, entirely destroyed the city of CATANIA, and 19,000 inhabitants of the island of Sicily: the undulations of this were felt, it is said, in Germany, France, and even in England. Fifty-four towns of some magnitude were, more or less, sufferers by this earthquake, and the total loss of human life amounted, it is supposed, to nearly 100,000.

The earthquake at JAMAICA in the previous year, 1692, was still more dreadful: the earth rose and fell like waves of the sea, and hundreds of chasms were seen opening and closing alternately; many persons were swallowed up in these, others crushed to death, with their bodies half out and half in them, and some, even after being buried alive, were cast out again with torrents of water. Three-fourths of the buildings of Port Royal sank down with all their inhabitants under the water, and long after, the roofs and chimneys of many were perceivable, at the distance of thirty and forty feet below the surface. A space of ground, about a thousand acres in extent, sunk down during the first shock, the sea rolled over it, and a frigate, then in one of the docks, was washed by the wave over the tops of many buildings. On the north of the island, the plantations, which covered upwards of a thousand acres, were swallowed up, and a lake appeared in their place; this afterwards dried up, leaving nothing but sand and gravel, without a trace of a house or tree having ever occupied the spot. The chain of mountains which traverses the island presented the most fearful signs of the violence of the convulsion; they were almost entirely stripped of their verdure and their woods, which were brought down by the rivers in such quantities, that several hundred thousand tons of timber were seen strewed on the face of the deep.

The first earthquake which is mentioned as having visited LIMA, since its establishment by the Spaniards, was in 1582; but was not of very serious consequence: six years after that time, however, one occurred, so fatal, that a solemn fast was appointed to be annually kept, and is still observed, in commemoration of it. In 1609, Lima was again injured by a shock, which destroyed many houses. In November, 1630, such extensive damage was done to the town by an earthquake, that an annual festival is observed on that day, in acknowledgement for its not having been totally annihilated; in the same month, twenty-four years afterwards, the city was again visited, and many hundred houses thrown down; but time and warning were vouchsafed to the inhabitants, who, consequently, suffered but little. Another percussion took place in 1678; but that of October, 1687, was more violent than most, if not all, which had preceded it. It commenced at four o'clock in the morning of the 28th, and by this first shock destroyed many of the public buildings and private houses, in which a great number of persons perished: two hours afterwards, the convulsions returned so rapidly and so powerfully, that the whole town was laid in ruins; though, from the previous warning, few additional lives were lost. During this second shock, the sea, first retiring considerably, reflowed in such enormous waves, as to overwhelm the town of Callao, five miles distant from Lima, and all the adjacent country, with its unfortunate inhabitants. No less than six additional earthquakes were experienced at Lima between this time and that at which the following occurred.

The earthquake which desolated PERU, in 1746, is considered as one of the most severe that country ever experienced: it began on the 27th of October, and in the course of the first twenty-four hours, two hundred shocks were felt. The sea retired twice from the shore, and flowed in again on the land with such impetuosity, as totally to destroy Lima, and several other places. Not only were nineteen ships, out of twenty-three, in the harbour, sunk, but the other four were carried, by the power of the waves, a great distance up the country—one of these was a frigate! Two hundred inhabitants alone were saved, out of four thousand who lived in the city; and these were rescued by the preservation of a small part of the fort of Vera Cruz, which was the only trace left of the situation of that once flourishing place.

In 1750, the ancient city of CONCEPTION, in CHILI, was totally destroyed by an earthquake; the sea rolled over it, and the bed of the ocean was so elevated by the shocks, that the port was rendered useless.

In 1759, SYRIA, and the adjacent countries, were devastated, during three months, by earthquakes, which ex-

tended over upwards of 90,000 square miles. Balbeck, Damascus, Tripoli, Sidon, Acon, and many other towns, were entirely or in great part destroyed; in each of which, thousands of inhabitants were victims. Twenty thousand are said to have perished in the valley of Balbeck alone.

THE EARTHQUAKE OF LISBON.

WHETHER considered with respect to its fatal violence, or to the extensive sympathy and interest it excited, no convulsion in nature, in the Old World, can compare with the destruction of Lisbon in November 1755. A subterranean noise, as of thunder, was heard between the hours of nine and ten in the morning of the 1st; the weather being as serene and lovely as is ever experienced in that favoured country. This was instantly followed by a shock which destroyed the greater part of the city, and in less than three minutes from the first sound, 30,000 persons were crushed under the falling edifices! The sea retired from the harbour and left the bar dry, and then rolled in again in an immense wave, rising fifty or sixty feet above its usual level; the mountains in the neighbourhood, which are some of the largest in that country, were shaken from their very foundations, and some were cleft and rent quite to their base, enormous portions of them being thrown down into the valleys, while electric flashes issued from their sides.

Many of the surviving inhabitants had rushed to the new quay which had been lately finished, and was constructed of marble, conceiving that it would be a place of security from the falling ruins; but this, on a sudden, sank down into an abyss which opened under it, drawing in along with it boats and small craft which were lying near it; and so completely was it swallowed up, that not a piece of timber of the wrecks, or one body of the thousands crowded on it, ever floated again to the surface.

The particulars of this melancholy catastrophe were recorded minutely by eye-witnesses who survived it, and the horrors they relate would only uselessly pain the reader, if it were not for many a moral lesson they convey. Some of these describe the dreadful situation of hundreds of their fellow-creatures lying half killed under the stones of walls that had struck them down, vainly imploring, with shrieks of pain, relief from their agony, which those whom they addressed were too powerless, too frightened, or too intent on self-preservation to be able to afford them.

The destruction of life was increased by the circumstance of the event occurring during the time when many churches were filled with their congregations, and these large and lofty buildings, being naturally the first that suffered from the shock, thousands were crushed at once by the fall of a single building; in one square of the city near the great church of St. Paul, were to be seen, according to the account of some, a crowd of persons who had had time to escape from it, collected round priests and bishops equally fortunate with themselves; and who, dressed in their sacerdotal robes, were offering up their prayers for succour and mercy from on high.

When night came on, after this day of horror, the city was seen to be on fire in different places, caused, of course, partly by the domestic fires of the inhabitants igniting the timber, furniture, &c., that was promiscuously buried with them, partly by the large wax-tapers which were burning in the churches, on account of its being a festival, but chiefly by bands of miscreants, who, unawed by the dangers they had hardly yet escaped from, and untouched by the misery and destruction of their fellow-creatures, deliberately set fire to the uninjured houses for the sake of profiting by the additional confusion thus created, to commit their robberies and atrocities with impunity; unfortunately such depravity has too many parallels in all times to make this either a singular or extraordinary instance.

The fire continued for six days to add to the desolation caused by the earthquake, for the survivors, rendered helpless by distress and fear, engaged in seeking for their friends, or disinterring the mangled corpses of those whom they found, were unable to take any steps to stop this fresh calamity. And, as a climax of horror to this picture of misery, it must be mentioned that the bodies of the dead, half roasted and burnt by the flames, so infected the air as to cause, for a long time, serious apprehensions of a pestilential disease.

The number of shocks in all felt in Lisbon, or its immediate neighbourhood, on this occasion, was about twenty-two, but the first three were the only serious ones; these occurred within a space of two or three hours, and the first

was, as we have stated, the most fatal. In all, the loss of lives was estimated at 60,000, but at such a time, and in such a country, no accurate account could, of course, be obtained. Four persons alone survived out of thirty-eight inhabitants of one house, and in the city prison alone 800, and in the general hospital 1200, were all killed.

This earthquake was the most extensively felt of any that have been recorded. Its effects were perceived over the whole of Europe, the North of Africa, and to the West Indies. We shall give a short notice of some of these at different places.

A sea-port called St. EUBAL's, about twenty miles south of Lisbon, was engulfed and totally disappeared. At Oporto the first shock was felt at half-past nine, as at Lisbon, and in the streets the earth was distinctly seen to rise and fall, but comparatively little damage was done; the river continued rising and falling four or five feet at a time, every fifteen or twenty minutes, for four or five hours, and violent gusts of wind were forced through the water from chasms which opened and shut again in its bed. At Madrid the shock was not felt violently, but at Cadiz the sea rose in a wave to a height of sixty feet, which carried away a large part of the breast-work of the fortification, and swept every thing off the mole; others, less and less violent, ensued for several hours, which washed up to the walls of the town.

At Tetuan, on the coast of Barbary, the earthquake began at ten in the morning, three shocks being felt in the space of seven or eight minutes, and at the same hour at all other places on that coast; at Fez many buildings were destroyed and lives lost in consequence, but, generally speaking, the principal effect was the rising of the sea, or more correctly, the progress of one principal and the consequently successive waves which washed along the shores, which were probably caused by the sudden heaving up, or sinking down, of a vast area of the bed of the Atlantic Ocean, under which the principal focus of the earthquake appeared to lie. Near Morocco, however, the earth opened and swallowed up a village with eight or ten thousand inhabitants, and then closed again over its prey: it is remarkable that on the 18th of the same month another earthquake was felt in these countries more violent and more fatal than that of the 1st: but this was much slighter in Europe, though it was felt at many places both in the Old and in the New World. To return, however, to that of the first: the great shock was felt by vessels at sea, and produced an effect on them similar to that of striking on a rock or sand-bank; in some the blow was so violent as to throw the sailors off their feet, to overturn the binnacle, and to cause the seams of the deck to open; and more than one captain, misled by these sensations, ordered out the boats, believing that they had, by an error in their reckonings, struck on some reef, but they found deep water all round their vessels.

The vast wave caused in the Atlantic by this earthquake reached, as we have seen, the coasts of Portugal, Spain, and Africa, and from the well-known undulatory motion of a body of water suddenly displaced, was succeeded by others, gradually diminishing in magnitude: but so enormous in extent was the first, that it was felt on many parts of our own coasts, at Portsmouth, and the southern harbours especially, where vessels, even in docks, shut in by flood-gates, were rocked backwards and forwards by the violence of the motion; and many forced from their moorings. Small rivers, canals, or pieces of water communicating in any way with the sea, were affected by this general wave, even to places far inland; but what is more extraordinary, even in numberless small ponds, agitation of the waters was clearly perceived, though no shock or motion in the earth was felt at the time; undoubtedly, however, it must have been chiefly to some such, that these effects were attributable, as very distinct tremors or concussions were perceived in several places, especially near to and at the bottom of a lead-mine in Derbyshire.

Effects either of the earthquake itself, or of this motion of the sea, were felt in a similar way in Norfolk, Lincolnshire, in the lakes of Cumberland, Durham, and Scotland, at the Hague, Leyden, Amsterdam, Rotterdam, &c.; at Kingsale and Cork, in Ireland; and even as far as Norway, at different hours, from 10 to 3, p.m.: according to the distance, or to other causes which regulated the progressive motion of the original shock. It was calculated from these data, that the subterranean movement was propelled at the rate of about twenty miles per minute.

At Toplitz, a village situated about nine miles north-

west of Prague, in Bohemia, celebrated for some warm baths, which had from their first discovery, nearly a thousand years before, constantly been supplied with an equal and regular quantity of clear water from some springs, a singular change was remarked between eleven and twelve o'clock, of the 1st of November; the supply of water suddenly increased greatly, and became very turbid; this, however, ceased shortly after, but the spring, ever since, continued more copious, and the temperature and medicinal properties of the water were augmented.

In 1772, an eruption of one of the highest volcanoes in Java occurred; before all the inhabitants on its side could escape, the ground began to sink, and soon after a great part of the mountain was entirely swallowed up, with adjoining ground, to an extent of area of fifteen miles long and six broad, together with forty villages, and 2900 persons; with an immense number of cattle, which were either engulfed by the earthquake, or buried by the volcanic matter. In this case, an example is presented, of simultaneous convulsion and destruction by both species of volcanic powers.

THE EARTHQUAKES OF CALABRIA.

CALABRIA and the adjoining countries, as being near the centre of the great volcanic region of the Mediterranean, are especially subject to the recurrence of earthquakes; one of these we have already noticed, but another, not less important, as well in extent and effect, as in duration, must now be described; and though it has been exceeded in all these respects by several, in other countries, yet from particular circumstances, we are possessed of more minute and accurate details of its various peculiarities.

The shocks began on February 5th, 1783, and continued at intervals, with different degrees of violence, for four years; the first threw down, in a few minutes, most of the houses of all the towns and villages in that part called Calabria-ultra, as well as the city of Messina: the concussion was felt as far north as Naples, and through the greatest part of Sicily; but the area over which the earthquake was violent enough to cause destruction and consternation, was not much more than four or five hundred square miles; within this limit, the whole surface of the country was entirely changed, innumerable openings and clefts were made in the surface of the ground, some of great length and width; many hills were levelled, and valleys filled up by their ruins; rivers were choked up, and springs of water broke forth where none had previously existed, while others were dried up. In one place near Laureano, two tracts of land, situated in a level valley, were transported to the distance of a mile, with all their trees and olives still standing; and volumes of hot water and sand issued from the ground where they formerly stood; and two others, on which a part of the town of Polistena was built, were moved nearly across a contiguous ravine to about half a mile from their former position, with some hundreds of houses on them, and many of the inhabitants, several of whom were extricated from the ruins alive and unhurt! Near Seminara, a large olive-ground was precipitated to a distance of two hundred feet into a valley sixty feet in depth, and this so compactly as to leave uninjured a house with its inhabitants, that stood on it, and the olive-trees continued to grow, and bore an abundant crop the same year in their new situation.

The permanent chasms or ravines caused by this earthquake, were of great size; one in the district of Plaisano, was a mile long, 105 feet broad, and 30 feet deep; another three quarters of a mile long, 150 feet broad, and above 100 feet deep; another was no less than 225 feet deep; one gulf at Fosolano, measured 300 feet square; and another, 750 feet square, and about 30 feet deep. A mountain at the southern part of the Peninsula, was cloven for the length of nearly half a mile, the opening being of an irregular breadth of many feet.

But in opposition to these, and many other comparatively harmless effects, long and frightful is the catalogue of suffering and misery: in the neighbourhood of Oppido,

* Sir William Hamilton, who wrote the most complete account of this earthquake, and from whose paper in the *Philosophical Transactions* these events are copied, afterwards spoke to one of these survivors, who, with his maid-servant and wife, were extricated; the former unhurt, but the latter, as the man said, "a little so, but she was then nearly recovered." On Sir William's asking him the nature of the injury his wife had received, he said, "she had had both her legs and one arm broken, and her skull so fractured, that the brain was visible!"

which town may be considered as the centre of the convulsion, many houses were swallowed up in gulfs which opened under and immediately closed again on them; in one district, four farm-houses, several magazines of oil, and some large dwellings, were so completely engulfed in one chasm, that not a vestige of them remained, and similar events occurred at other places; in some cases where excavations were afterwards made, in the hopes of recovering valuable property, the workmen found the buildings and their contents crushed into one compact mass.



Fissure near Polistena, caused by the Earthquake of 1783



Circular Hollows in the Plain of Rosarno, caused by the same.

Along the sea-coast of the straits of Messina, near the classical rock of Scylla, the huge masses detached from the lofty cliffs, overwhelmed many villas; the water, as usual, was violently agitated, and showed that the subterranean motion was not less active beneath the bed of the sea, than on shore. The prince of Scylla, an old man, on the occurrence of the first shock, observing the effects produced on the cliffs, on which his own castle and the houses of the town were situated, advised the inhabitants to get boats ready, and to assemble on the shore, to be ready to escape in them, if another shock should bring down the rock above them. This actually occurred to a mountain at some distance, near midnight; and whether from this falling partly into the sea, or from the immediate effects of the second convulsion, an enormous wave flowed along the low beach, carrying away boats, people and all with it, either dashing them against the rocks, or washing them out to sea, so that the prince, and 1400 of his people, perished.

The peasants informed Sir W. Hamilton, who visited the greater part of the country in the May following; that the motion of the earth was so violent as to cause the loftiest trees to bow their heads to the ground repeatedly; that animals gave evident signs of being aware of the approach of each shock, and that during them, oxen and horses spread out their legs, in order to avoid being thrown down. Another very touching circumstance was repeatedly told him; when the bodies were dug out, or discovered, those of the men indicated, by their attitude, that they had struggled to the last; while the females appeared to have

resigned themselves more calmly, or were found clasping the bodies of their children, as if endeavouring to shield them from the danger.

In his progress through the country, the effects of the earthquake presented themselves on every side, with the most melancholy and various features. Wretched hovels, erected for shelter, near heaps of ruins, with a few mournful figures sitting at the doors, all bearing some token of grief for the loss of near relatives; while maimed and crippled persons, men, women, and children, were seen crawling about on crutches. In the town of Polistena, 2100 out of 6000 inhabitants, lost their lives on the first fatal day; one nun, aged eighty, was the only survivor of a nunnery containing twenty-three, and she had been dug out of her cell alive! At Terra Nuova, 400 only escaped out of 1600. He saw two girls who had been rescued from the ruins of Oppido, after having been buried for many days. One, aged sixteen, had remained eleven days without any food; but an infant of six months old, which she had in her arms at the time of the accident, died on the fourth day. She was then recovering, but still very feeble, and had great difficulty in swallowing solid food; the other girl was only eleven years of age; she had been immured only six days, but in so cramped a position, that her hand had nearly worn a hole through her cheek, against which it had been pressed. Many instances are narrated of animals, as mules, dogs, hogs, and hens, having survived, after being buried, without food, for more than three weeks.

The city of MESSINA has been already mentioned as suffering by this calamity; its spacious harbour previously presented the appearance of a magnificent range of houses, built along its shore for more than a mile; the dwellings of the opulent inhabitants: these, with the greater part of the town, were rendered a heap of ruins. The progressive motion of the first shock, and the previous noise, however, allowed most of the inhabitants time to escape; so that only about 800 were killed by the fall of the buildings. The second, which did not take place till midnight, destroyed the rest of the town; and another, on the 7th, swallowed up the Mole, which was more than a mile in length. Here, however, as at Lisbon, the calamity was aggravated by a fire, which immediately broke out in all parts of the city, among the half-ruined edifices, which completed the destruction of all that the earthquake had spared.

Spallanzani, who visited the place nearly six years afterwards, found the city still a mass of ruins; and the streets, except some of the principal ones, impassable; the inhabitants had begun to rebuild their dwellings, and that on an improved plan, better calculated to obviate the effects of such another visitation; but, even at that distance of time, he describes them as hardly recovered from their consternation, and still chiefly residing in the temporary wooden sheds they had erected in the neighbourhood, for shelter after the catastrophe.

The total number of persons who perished on this occasion, either immediately from the shocks, or subsequently from an epidemic, which was caused by the stagnant waters, or by want of proper food, amounted, it is estimated,

to 60,000*, one-third only of which died from the subsequent effects, the rest being crushed in the ruins, engulfed in the earth, or burnt by the fires.

On this, and on other occasions, the shocks were observed to have different characters, which have consequently been distinguished by separate names, as expressing the kind of motions, as *vorticose*, or acting in a whirling manner, horizontal and *undulatory*, like waves in water, or vertical and *oscillating* up and down. Most of those in this earthquake came from the west, were preceded by a rumbling noise, usually beginning with the horizontal motion, and ending in the vorticose, by which the buildings were chiefly overthrown. These various motions often produced very singular and capricious effects; in some streets of Monteleone only every other, or every third house, was destroyed, while the intermediate ones were hardly at all injured.

In some cities, the most solid structures were thrown down, while the slighter ones escaped; and in others precisely the reverse took place. On some occasions, the first species of shock turned large stones quite round, without overthrowing them; and a great extent of the flat paving-stones of some streets were thrown up from the ground, and turned over, so as to fall in an inverted position.

In some walls which had been overthrown, the stones were observed to have parted from the mortar, so as to leave an exact mould of their forms; while, in other instances, the mortar was ground to powder between the stones, proving a considerable motion to have been communicated to them before the wall fell. In the town of Terranuova, some houses were elevated by the shocks above their former position, while others, immediately adjoining, were sunk into the ground; and in more than one instance, buildings were even split in two, one half being raised up, while the other sank down, the two parts still adhering together.

In several streets, the earth was thrown up against the walls in embankments, as if done artificially. These, and other appearances, indicate a violent motion of the earth from below upwards; and where rents and chasms opened and closed alternately, it must have been caused by the ground being raised up, and then let fall again. In many instances, persons were swallowed up in such chasms, which completely closed over them, and were soon after thrown out again alive, amidst torrents of mud and water, on the occurrence of the next shock; the same thing has been mentioned as having occurred in Jamaica, in 1692. But it may easily be supposed that these individuals could not afterwards give any very distinct account of this unnatural interment; indeed, the effects produced on the minds and intellects of different persons by such terrors, are not the least interesting of the lessons taught by these events.

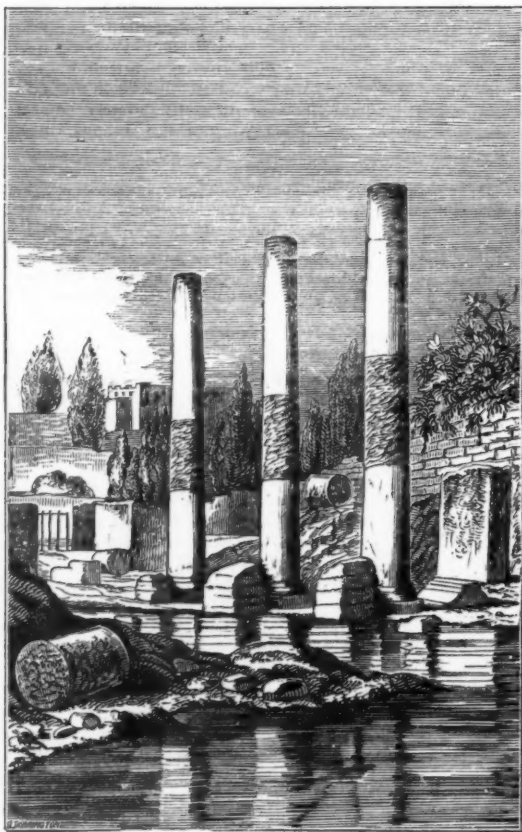
* There are many battles recorded in history, in each of which a far greater number of persons were slain than ever died by any one natural visitation of volcano, earthquake, or pestilence; yet we read of the mutual slaughter of fellow-creatures with comparative indifference, forgetting that the moral guilt ought to excite more grief than the destruction of life alone; how much happier are those to be considered, who die by an earthquake, than those who fall on a battle-field!



View of the City of Catania.

Our readers will not be sorry to have this catalogue of horrors interrupted by an account of a curious induction made by men of science, from some facts which might not appear worthy of notice to common observers, but yet lead to very convincing proofs of effects, of the causes of which no other records are handed down to us.

An examination of the Bay of Baïæ had led to a conclusion that an elevation of this coast to a height of twenty feet had been produced by some earthquake, at no very remote period; but the evidence of this was not so conclusive as to induce all to acquiesce in the opinion. The remains of an ancient building commonly called the Temple of Serapis, however, furnished the deficient corroboration of this fact. These ruins were not discovered till 1750, on the removal of some rubbish and bushes, which had, till then, partly concealed them from observation. They were found to constitute part of a splendid edifice, the pavement of which was still preserved. It had been of a quadrangular form, and the roof supported by forty-six columns of granite, or marble, remains of which were lying on the ground, and three only left standing, which are forty-two feet in height. To the distance of about twelve feet from their bases, the surface of these is quite smooth and uninjured; above, for another space of twelve feet, the marble has been pierced and corroded by a species of shell-fish, well known, the remains of which are found at the bottoms of the perforations they had made; and the depth and size of these proved that the columns had been long exposed to their attacks. Hence it appeared, that while the lower part of these pillars had been protected by being buried in rubbish or earth, the sea had surrounded them to a depth of twelve feet at least; and the upper part, having been exposed to the air, was weather-worn accordingly. The columns which are overturned on the floor of the building, are corroded in the same way in parts which had been exposed to the sea-water, and consequently to these animals. But as the temple could not, for obvious reasons, have been originally built in the sea, it must have sunk down after its construction, from the effects of an earthquake; and after continuing thus partly submerged for a length of time, another convulsion must have elevated its ruins again: so that, at present, its pavement is raised about a foot above the level of the sea.



Remains of the Temple of Serapis, at Pozzuoli

And other ruins in the neighbourhood, besides two Roman roads, which are still visible beneath the waters, confirm the fact of the subsidence, though these have not been re-elevated, as the temple has*.

SOUTH CAROLINA, in America, was shaken by earthquakes, in 1811, which continued till the destruction of the Caraccas, in the following year. The valley of the Mississippi, from New Madrid to the mouths of the Ohio and St. Francis, was convulsed to such a degree as to cause the formation of several large lakes and islands. A tract of country many miles in extent, near the Little Prairie, on that river, was covered with water three or four feet deep; and when this disappeared, it left a plain of sand: some of the lakes were twenty miles in extent, and were formed in the course of an hour; and others were as rapidly drained. The burial-ground at New Madrid was precipitated into the river; and the inhabitants of that city state that the earth rose in great waves, which, when they had reached a fearful height, burst, and volumes of water and sand were thrown up into the air, to the tops of the trees. Seven years afterwards, the remains of hundreds of these fissures were still to be seen. On this occasion, a degree of presence of mind was shown by the people, rarely met with on such occasions; and the more remarkable, because experience had not inured them to such events. They observed that these chasms in the ground ran from S. W. to N. E.; they accordingly cut down large trees, so that they might fall at right angles to this direction, and stationed themselves on the trunks: by this expedient of a bridge, as it were, they were preserved from being swallowed up by fissures which opened repeatedly beneath them.

DESTRUCTION OF CARACCAS.

On the 26th of March, 1812, at five in the afternoon, after a calm but excessively sultry day, a tremulous motion in the ground was felt, sufficiently strong to set the church-bells ringing; this lasted five or six seconds, and the earth continued undulating like the sea in a calm for ten or twelve more; subterranean noises were then heard, and electric discharges perceived, more powerful than those during an average thunder-storm, and the agitation of the earth increased to such a degree, both of the oscillating and horizontal kind, that in the short space of a minute the whole city of Caraccas, with upwards of thirty other towns, and numerous villas, farms, and other buildings in the adjacent country, to an extent of 300 square miles, were completely overturned, and 80,000 persons killed, and thousands more wounded. This city stood at the foot of the declivity of the highest mountain in that country, called La Silla, and on the margin of an immense plain, through which several rivers flowed; it was elevated considerably above the level of the sea, and enjoyed a remarkably fine climate. The day of this awful catastrophe happened to be Good Friday, and the people were crowded in the churches, beneath which they were buried by thousands; two of these, La Trinidad and Alta Gracia, in the immediate neighbourhood of the mountain, experienced most forcibly the effects of the shock; they were upwards of 150 feet in height, and no portion of their ruins, exceeding five or six feet high, were left standing.

As soon as the first panic was over, the survivors set to work to rescue those who lay buried in the ruins and yet lived, or to collect the bodies of the dead for burial; but these were too numerous to admit of being interred, and, in order to avoid a pestilence from the decaying corpses, they were obliged to be burnt in piles with the timber from the ruins.

In such a country, the want of water was soon experienced as a great aggravation of the evil; for all the cisterns and conduits were ruined, and the springs and rivulets either dried up or diverted from their course. Hunger was next added to the other calamities; no provisions were saved, and none were brought to market, and many persons absolutely died from want of food.

The shocks continued for many months; some so violent as to rend several mountains asunder, frequently occurring at intervals of only five minutes for days together, and that was thought a very tranquil one on which only fifteen or twenty were experienced.

It is curious to remark the effects of such a calamity on the human mind, according as it is influenced by remorse,

* Abridged from Professor Lyell's work on Geology, to which we are again indebted.

or fear. In less than two days after the first blow, two thousand individuals were married, who had previously lived in unhallowed union. Many poor relations, who had hitherto been neglected, were sought for and acknowledged by their wealthy kindred; neglected children were owned, and legitimate restitutions were made, and law-suits terminated; while the timid and the depraved either accused themselves of concealed crimes, owned to murders they had committed, others rushed to fresh excesses, and to the perpetration of new enormities.

An earthquake occurred in CHILI, on the 4th of April, 1819, of the effects and consequences of which Captain BASIL HALL gives some interesting particulars, in his work, intitled *Extracts of a Journal on the Coast of Chili*, &c. in 1821-22. From these we select the following.

"It was interesting to notice how constantly the earthquake occupied all people's thoughts at this place, however much they might seem to be engrossed by other objects. An English gentleman, residing at Copiapo, invited me to visit a family of his acquaintance, living in the undestroyed suburb Chimba, promising to show me the handsomest young woman in Chili. We found her very pretty and agreeable; but what entertained us was, her vehement desire to have a wider field for the display of her charms. The accounts she had heard from others, of the fashionable world of Santiago and Coquimbo, had so completely turned her head, that even earthquakes ceased to make the usual impression. 'I see,' said she, 'other people running out of their houses, full of terror, beating their breasts, and imploring mercy, and decency, of course, obliges me to do the same; but I feel no alarm; my thoughts are all at Coquimbo.' We consoled her as well as we could; and, as she had spoken of earthquakes, asked her if there had been one lately. 'No,' she replied, 'not for some time. I really do not think I have felt one myself for three days. Somebody said there was one last night; but I knew nothing of it. I am tired of these earthquakes, and would never think of them again, if I were at dear Coquimbo.'

"On putting the same question to another person, he said, they had not experienced one since April; meaning, as I discovered, April, 1819, two years and a half before; not conceiving we could be interested in such petty shocks as would not demolish a town.

"While listening to these descriptions, we were much struck with the occasional introduction of minute characteristic circumstances. One of the party, for instance, was describing the effect of a severe shock, which, he said, happened at four o'clock. 'Oh, no,' said another, 'it was later, I assure you.' 'Indeed, it was not,' replied the first, 'do not you remember we were playing at bowls at the time, and when the sound was heard, I stopped playing, and you called out to me to look what o'clock it was.'

"Upon another occasion, our host said, 'I was just going to look what the hour was at which one of those sounds was first heard, when my attention was diverted from the watch by a hideous scream of terror from a person near me. He was such a little insignificant fellow, that I could not conceive such a yell could come from him; and so we all forgot the shock, in quizzing this little mannikin.'

The quickness with which natives of countries exposed to frequent earthquakes feel them, when strangers are not aware of their existence, is also mentioned by the same gentleman.

"In the course of a long walk which our party took after dinner, an earthquake was felt. We were walking slowly along, when the gentlemen stopped, and one of them seeing us look surprised at their doing so, cried out,—'Temblo!' (Earthquake.) A sound like distant thunder was then heard for about a quarter of a minute; but it was impossible to say from whence it proceeded; and, though conscious that there was something unusual in the noise, I cannot say exactly in what respect it was particular. The residents declared that they felt the tremor; but none of us were sensible of any motion. This was the fifth occasion, since my arrival in the country, on which I had been present at earthquakes, without ever feeling any of them in the slightest degree."

An earthquake commenced in Chili on the 19th of November, 1822, the first shocks of which were felt, at the same moment, over a distance of 1200 miles, and the coast, for a length of 100 miles from Valparaiso, was raised more than three feet above its former level; part of the bed of the sea remained dry at high water, and there is reason to believe that a permanent change of surface, with respect to elevation, was effected over 100,000 square miles.

The shocks continued to the end of the ensuing September, and, even at that distance of time, two days never passed without one, and often two or three were felt in the course of twenty-four hours.

The following account of the effects experienced on this occasion are narrated by Mrs. Graham, in her *Journal of a Residence in Chili*, and convey a vivid idea of such an event; the authoress was at Quintero about thirty miles from Valparaiso.—

"November 20th.—Yesterday after dinner, Glennie having fallen into a sound sleep in his arm-chair by the fire-side, Mr. Bennet and I, attracted by the fineness of the evening, took our seats to the veranda, overlooking the bay; and for the first time since my arrival in Chili, I saw it lighten; the lightning continued to play over the Andes until after dark, when a delightful and calm moonlight night followed a quiet and moderately warm day. We returned reluctantly to the house on account of the invalid, and were sitting quietly conversing, when at a quarter past ten, the house received a violent shock, with a noise like the explosion of a mine; and Mr. Bennet starting up ran out, exclaiming 'An earthquake, an earthquake; for God's sake, follow me!' I, feeling more for Glennie than any thing, and fearing the night-air for him, sat still: he, looking at me to see what I would do, did the same; until the vibration still increasing, the chimneys fell, and I saw the walls of the house open. Mr. Bennet again cried from without, 'For God's sake, come away from the house!' So we rose and went to the veranda, meaning of course to go by the steps; but the vibration increased with such violence, that hearing the fall of a wall behind us, we jumped down from the little platform to the ground; and were scarcely there, when the motion of the earth changed from a quick vibration to a rolling like that of a ship at sea, so that it was with difficulty that Mr. Bennet and I supported Glennie. The shock lasted three minutes; and by the time it was over, every body in and about the house had collected on the lawn, expecting two persons, one the wife of a mason, who was shut up in a small room which she could not open; and the other Carillo, who in escaping from his room by the wall which fell, was buried in the ruins, but happily preserved by the lintel falling across him.

"Never shall I forget the horrible sensation of that night! In all other convulsions of nature, we feel or fancy that some exertion may be made to avert or mitigate danger; but from an earthquake there is neither shelter nor escape: the mad 'disquietude' that agitates every heart, and looks out in every eye, are too awful to be described. Amid the noise of the destruction before and around us, I heard the lowings of the cattle all the night through: and I heard the screaming of the sea-fowl, which ceased not till morning. There was not a breath of air, yet the trees were so agitated that their topmost branches seemed on the point of touching the ground. I got a man to hold a light, and venture with me to the inner rooms to fetch medicine. A second and a third shock had by this time taken place, but so much less violent than the first, that we had reasonable hopes that the worst was over, and we proceeded through the ruined sitting-rooms to cross the court where the wall had fallen, and as we reached the top of the ruins, another smart shock seemed to roll them from under our feet; at length we reached the first door of the sleeping-apartments, and on entering I saw the furniture displaced from the walls, but paid little attention to it; in the second, however, the displacing was more striking, and then it seemed to me that there was a regularity in the disposal of every thing; this was still more apparent in my own room, but it seemed in all to have been moved in the same direction. The night still continued serene, and though the moon went down early, the sky was light, and there was a faint aurora-australis. It was now twelve o'clock; the earth was still at unrest, and shocks accompanied by noises like the explosion of gunpowder, or rather like those accompanying the jets of fire from a volcano, returned every two minutes; and then, wearied out, I fell asleep; but a little before two, a loud explosion and a tremendous shock roused every one, and a horse and pig broke loose and came to take refuge among us. At four o'clock, there was another violent shock, and the interval had been filled with a constant trembling, with now and then a sort of cross motion, the general direction of the undulation being North and South. Since that hour, though there has been a continued series of agitations, such as to spill water from a glass, and though the ground is still trembling under me, there has been nothing to alarm us.—At day-light, I went out of the tent

to look at the earth, the dew was on the grass, and all looked beautiful as if the night's agitation had not taken place.—Half past eight P.M., the evening is as fine as possible, the moon is up, and shines beautifully over the lake and the bay, the stars and the aurora-australis are also brilliant, and a soft southerly breeze has been blowing since daylight.

"*Thursday, November 21.*—At half-past two, A.M., I was awake by a severe shock; at ten minutes before three, a tremendous one, which made us feel anew that utter helplessness which is so appalling.—Five others, in the course of the day, of different degrees of severity, were all that were in any degree alarming, but slight ones occurred every twenty or thirty minutes. I learn, not one house in the port remains habitable, though many retain their forms. There is not a living creature to be seen in the streets, but the hills are covered with wretches driven from their homes, whose mutual fears keep up mutual distractions. The ships in the harbour are crowded with people; no provisions are to be had; the ovens are ruined, so that the bakers cannot work.—We had the same prophecy of a greater shock; that it did not happen has been attributed to the interposition of our Lady of Quintero, who has a chapel at the old house, and her image has long been an object of peculiar veneration. All the women of the neighbourhood flocked thither on the first dreadful night, and with shrieks, cries, and endearing names, entreated her to come to their assistance: in the morning, when the priests were able to force the doors, obstructed by the fallen rubbish, they found her prostrate, with her head off, and several fingers broken; she was soon restored, however, to her pristine state, dressed in clean clothes, and placed in the attitude of benediction before the door of her shattered fane.

"Don Fausto reports from Quillota, that the 19th being a festival of St. Martin, the tutelary saint, the marketplace was crowded with people, and booths, and bowers of roses and myrtles; under which all kinds of feasting, revelling, dancing, fiddling, masking, and every species of dissipation, or rather dissoluteness, was going on. The earthquake came!—and in an instant all was changed. Instead of the sounds of the viol and the song, there arose a cry of '*misericordia*,' and a beating of the breast, and a prostration of the body: the thorns were platted into crowns, which the sufferers pressed on their heads till the blood streamed down their faces, the roses being now trampled under foot. Some ran to their falling houses, to snatch thence their children, forgotten in the moments of festivity, but dear in danger.—Among the rest, came Don Duenas: he had been in his house with his wife and child; he could not save both at once, and while he was bearing her out, the roof fell, and his infant was crushed. His loss of property had been immense.—This man, then, with this load of affliction, came to Fawkner (deputy governor), and told him he had ordered already four bullocks to be killed and distributed to the poor; and desired him to remember, that though his losses had been severe, he was still, comparatively, a rich man, and therefore able, as well as willing, to assist his neighbours and fellow-sufferers.

"*Saturday, 24th.*—As I approached nearer, the tents and huts of the wretched fugitives claimed my attention; and there I saw the calamity in a light it had not hitherto appeared in. Rich and poor, young and old, masters and servants, huddled together, in intimacy frightful even here, where distinction of rank is by no means so broad as in Europe.—I fear that whatever cause makes large bodies of men very miserable, makes them also very wicked.—Poor Maria came to me evidently sick at heart, I asked for her little boy, she burst into tears.—He was sleeping in the rancho, on his little bed; she had been out at a neighbour's house, she ran home to seek her son: he lay on his bed, but a rafter had been shaken from its place, and had fallen on his little head; and from the face alone she could not have known her own child. They came to take the body, and bury it; she had not four dollars in the house; the priests, therefore, as she could not pay the fees, refused to bury it in consecrated ground; and 'they have thrown my child into a pit, like a dog, where the horses and the mules will walk over him, and where a Christian prayer will not reach him!' All comment on this would be idle.

"*Monday, 25th.*—I have been busy all day packing my books, &c., to remove, because my house has been let over my head to some persons, who, seeing how well it has stood, have bribed the landlord to let it to them—they are English!"

Our limits will not allow of our giving further extracts from this lady's account, who remained in the country till January 17th, and has recorded many circumstances of great interest relating to this catastrophe.

THE slight shocks occasionally felt in our own country may more properly be considered as the remote effects of a more powerful convulsion at some place situated within the various volcanic ranges by which we are surrounded, though distantly; and this is rendered more probable, by the circumstance of these feeble visits commonly agreeing in the time of their appearance with that of a violent commotion, of which the account is subsequently received from other countries. Providentially, no greater damage has ever arisen from them than the shaking of houses, causing bells to ring, or furniture to move, &c. God has been pleased to exempt us from great calamities: but while it appears, from observation, that England is not, nor has been for many ages, within the sphere of volcanic activity, yet geological researches incontestably prove that there was a time, long before all human records, when this country, as well as others, was subjected to fiery eruptions, and, therefore, most probably to earthquakes. We have alluded in previous numbers to the convincing testimonies of this country having for ages enjoyed a tropical climate; and as far as experience goes, it appears that volcanic eruptions are *principally* felt in tropical or neighbouring countries. In the recurrence of those cycles in which the surface of the globe appears to be gradually but constantly changing its character and temperature in succession, it may be expected that this part of Europe may again be visited by these terrific powers; but these are rather speculations for the philosopher, than interesting to the common reader, and we therefore refrain from dwelling further on the subject.

AFTER reading the foregoing accounts of the desolating effects of volcanoes and earthquakes, some natural and pardonable doubts may arise in the minds of many, who, though convinced of the uniform wisdom and benevolence of the whole scheme of creation, may yet be perplexed to trace them in this frequent recurrence of visitations, apparently only involving thousands, innocent as well as guilty, in one sudden destruction: but here, as in so many other cases, science and philosophy step in to dissipate these painful suggestions, and to vindicate that universal wisdom, by proving that without these catastrophes this globe would have been long ago, and might yet become an uninhabitable waste.

Those inequalities of the earth's surface, which render it by variations in temperature and soil so eminently adapted to the existence of myriads of different races of beings, are constantly being reduced by the ceaseless action of air and water. The mountain rill, swollen by rains into a torrent, washes down fragments of rock detached by atmospheric causes; these are borne in time, by rivers, to the ocean, and the waves of this last are perpetually preying on the shores and cliffs, and gradually wasting away the elevated dry land; converting by degrees, continents into islands, and causing islands to disappear. These causes, if not counteracted, would, in time, reduce the whole surface of the planet to one nearly uniform level, possibly below that of the ocean, and thus render it uninhabitable but to few and inferior orders of beings. The antagonist power to this silent but ceaseless destruction, resides in the volcano and the earthquake, which are perpetually at work in restoring by violent efforts, these inequalities of level; either by gradually raising new mountains, by elevating islands from the bosom of the deep, or by raising extensive plains several feet at a time, above their former altitude; and thus the enlightened mind may perceive in these awful visitations, which bring death and ruin in their train, the efficient causes of the continued existence of millions of beings, to enjoy the bounties, and to testify to the power of the only true God.

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